

Definition

Claudication is a pain, cramp or sense of fatigue in a muscle group of the lower extremity related to sustained exercise and relieved promptly by a few minutes of rest while standing evenly on both feet. Claudication occurs elsewhere in the body, but it is the symptom arising in the legs that has major clinical significance.

Technique

A history of intermittent claudication is among the most definitive in all of clinical medicine. An anatomic diagnosis of arterial obstruction can be made on the basis of history alone in most cases. The interviewer should inquire about the nature of the extremity pain and explore such factors as duration, location, progression, reproducibility with exercise, and rest time necessary to afford relief. Because some patients do not regard the sensation in their leg as pain but instead describe it as tiredness, weakness, cramping, burning, aching, or "dead weight," it is preferable to begin the inquiry without using pain as the topic. A general question related to function of the lower extremities usually results in a characteristic description of symptoms by patients with intermittent claudication. One may ask simply, "Do you have any difficulty walking?" or, "How far can you walk without having to stop to rest?" If the patient gives an indication in his reply that his ability to walk is limited by discomfort in the legs or that he is unable to walk as far as 8 to 10 city blocks without stopping to rest, the examiner should encourage him to describe what happens when he tries to walk. The patient may then relate a typical sequence of walk—pain—rest—relief, but leading questions are often useful in getting the full story: Does the pain occur only with exercise? If so, in what part of the leg? How long does it last? What can be done to relieve it? If it disappears with rest, as is typical of arterial claudicatory pain, can he then walk again for the same distance? What is the effect of more strenuous muscular exertion, such as walking up an incline, climbing stairs, jogging, or carrying a weight? The discomfort is usually experienced as a dull, aching pain in the calf, but it may be sharp and can radiate up and down the limb to involve thigh, hip, buttock, and even foot muscles. The pain is usually located in one leg; both legs may be involved, although one is generally worse and serves as the main impediment to ambulation. Some individuals say that the first sensation is fatigue or weakness and that true pain develops only if they persist in exercising without pausing to rest when the initial symptoms appear. Others observe that if they continue to walk despite the pain, they eventually experience numbness, limping, or such severe muscular cramping that they are totally unable to proceed. Indeed, forcing the limb to exercise beyond its claudication limit can produce tissue damage with resultant soreness, tenderness,

and lameness for several days. Patients with very-short-distance claudication and severe arterial insufficiency may describe paresthesia or numbness of the toes and forefoot in association with their intermittent claudication symptoms.

The general trend is for claudication to worsen gradually over a period of years. Nevertheless, at any given stage claudicatory distance is fairly constant provided the conditions of terrain, incline, and speed of walking are the same. Typically the symptoms progress in episodes with stable periods, or even intervals of improvement, interspersed between exacerbations. Claudication may become acutely more severe, and progress to the point of rest pain, if the patient develops a second segment of arterial obstruction (tandem lesions), sustains thrombosis of a previously stenotic arterial segment, or suddenly loses a major collateral pathway.

When taking a history of claudication, it is useful for both the physician and the patient to consider distances in terms of the average, level city block. Imparato et al. (1975) classified "mild claudication" as the ability to walk 2 to 3 blocks (900 feet) before stopping; "moderate claudication," 1 or 2 blocks (600 feet); and "severe claudication," less than 1 block (300 feet). It is important in the questioning to establish that the pain does not occur simply upon standing up and that it does not persist more than a few minutes after stopping to rest. These symptoms would be more suggestive of pain caused by neurologic or musculoskeletal disorders. Night cramps, which occur while in bed, and pain on prolonged standing or sitting, which may suggest chronic venous disease, also should be differentiated by history. If the patient is uncertain about these points, or gives a history that is suggestive of intermittent claudication but not typical, the examiner may ask the individual to reproduce the symptoms by climbing stairs or by having the subject perform treadmill exercise under observation. When the claudicatory pain appears, its nature, location, duration, and response to rest can be recorded and the affected extremity's pulses and Doppler pressures determined. While taking the remainder of the medical history, the interviewer must correlate a history of claudication in the male patient with any description of impaired sexual performance, as dysfunction in both areas may suggest aortic obstruction (Leriche's syndrome).

Basic Science

Intermittent claudication is not a diagnosis but a symptom. It refers to a condition of lameness and pain in the lower extremity precipitated by muscular exercise and relieved by 1 to 2 minutes of rest while the patient remains standing. When present, it is a rather specific and reliable indicator of arterial insufficiency of the leg. In a situation of gradual arterial occlusion the blood flow may be adequate to maintain a comfortable limb at rest or with limited activity, but

upon more vigorous exercise the muscle groups distal to a level of major arterial obstruction receive inadequate circulation to meet metabolic demands. The resulting pain is thought to be due to an accumulation of irritating metabolic products in the ischemic muscle, causing stimulation of sensory nerves. When claudicants stand still to rest, they achieve relief of pain by allowing the blood supply to catch up with the previously increased metabolic activity. Subjects may then walk again for the same distance, with the same sequence of events. Such pain does not occur in persons with normal circulation because metabolic products can be removed adequately by the abundant blood flow present in the normal exercising limb. While the pain of claudication is usually of a dull, aching type, on occasion it may be excruciating or totally disabling, especially if the individual persists in walking despite ischemic symptoms. Although a brief period of rest generally affords prompt relief of claudicatory pain, patients with more severe arterial impairment or those who do not yield to the pain signal may note persistent tenderness or soreness of the affected muscle for some time thereafter. This is presumably the result of ischemic myositis caused by forcing the muscle to perform beyond its blood flow limit.

Similar pain to that characteristic of intermittent claudication has been produced in experimental subjects by having them exercise a limb in the presence of arterial inflow obstruction, severe anemia, or reduced oxygen content of the arterial blood. Lewis et al. (1931) reported that claudicatory pain could be reproduced by exercising an otherwise normal limb with its arterial blood supply stopped. Soon thereafter, Kissin (1934) made the observation that normal human subjects experienced crampy pain in an exercising muscle group while breathing a gas mixture containing a reduced content of oxygen. He theorized that the pain was not due to hypoxemia per se, but to the local buildup of metabolic products resulting from an insufficient supply of oxygen to the tissues. Pickering and Wayne (1934) described typical intermittent claudication in several severely anemic patients, completely relieved by cure of their anemia.

It is well known that pain on muscular exertion can occur in the forearm or hand of a patient with upper extremity vascular compromise. Such discomfort is uncommon in that setting, however, because of a more adequate collateral system in the arm and less vigorous muscular activity of that extremity as compared to the leg. Persons who perform heavy physical labor or athletes involved in sports that require repetitive arm motion are more likely to complain of arm claudication than sedentary individuals with the same degree of vascular obstruction. Infrequently, patients describe claudicatory pain of the masseter muscle due to arterial insufficiency caused by obstruction of the ipsilateral common or external carotid artery. Pain associated with mastication is rarely mentioned by the patient with typical atherosclerotic occlusive disease, but is more characteristic of Takayasu's arteritis.

Clinical Significance

The word *claudication* is from the Latin *claudicare* meaning "to limp," but it has been adopted in medical terminology to describe a painful limp associated with exercise. According to Lewis et al. (1931), the term *intermittent claudication* first appeared in the veterinary literature in 1831 in the title of a paper by Bouley describing a condition of lameness

in a horse that came on after exercise and was traced to obstruction of blood flow to one limb. In the latter part of the nineteenth century the term was picked up and used by physicians to describe similar lameness in humans affected with "senile arteritis" or arterial aneurysms. Erb, in a publication in 1898, helped to popularize the term; he attributed the walking disability to pain produced by muscular exercise in a limb deprived of blood flow. Subsequently it has become generally recognized as a hallmark of chronic arterial insufficiency of the lower extremity, most commonly occurring in the presence of atherosclerotic occlusive disease.

Claudication is the most frequent complaint mentioned by patients with that disorder and is usually the first indication of significant arterial obstruction to the leg. Although atherosclerosis is a diffuse process, the more severe arterial obstructions are segmental in location. As the atheromatous lesions progress in the major vessels, collateral circulation develops and may be sufficient to preserve viability and prevent symptoms at rest. Indeed, a sedentary lifestyle may permit peripheral vascular occlusion to proceed to an advanced state with minimal or no symptoms. Claudication finally occurs when the collateral circulation is no longer adequate to supply the increased blood flow demands of exercising muscle distal to the obstruction. The severity of the patient's claudicatory symptoms depends on the pattern of occlusion, the degree of stenosis, the rate of progression, and the adequacy of the collateral bed. More severe, or rapidly worsening, claudication may signal extensive segmental occlusion or multiple levels of blockage precluding adequate collateralization. Perdue et al. (1971) emphasized the highly variable patterns of lower extremity atherosclerotic disease. Claudication may worsen as the underlying disorder progresses, or it may remain stable for years in many individuals. If the collateral system gradually enlarges with time, or if greater muscle efficiency can be achieved by the patient through exercise, his claudication may actually improve. Imparato et al. (1975) reported that 79% of claudicants followed for an average of 2.5 years remained stable or improved over the period of observation. In contrast, if the collateral itself becomes occluded or another major arterial block develops, the symptoms may suddenly worsen and can progress to rest pain, ischemic ulceration of the skin, or gangrene of the limb. Reports by Imparato et al. (1975) and Peabody et al. (1974) would suggest that the risk of eventual amputation is relatively low in patients with intermittent claudication as their presenting complaint, because only 6% and 2.5% respectively required major amputations during observations averaging 2.5 and 8.3 years.

The location of claudication pain can be used to predict the site of major arterial obstruction because the affected muscle group is typically one joint distal to the level of vascular occlusion. The physician, therefore, can localize the segment of anatomic obstruction by history alone: If the pain is confined to the calf, the superficial femoral artery is the likely site; if in the thigh and calf, the iliofemoral segment; if in the buttock and distally, the aortoiliac segment. It is unusual to have isolated foot claudication as a symptom of atherosclerotic occlusive disease, but this may occur in Buerger's disease or other tibial arteritides. If the claudicatory discomfort is confined to the trochanteric region or buttock, it may be an indication of isolated internal iliac and/or profunda femoris insufficiency. Usually physical examination of the peripheral vascular system will corroborate these principles, but arteriography may be necessary to define the extent of the disease with precision. While

atherosclerosis is the basis for the great majority of cases of claudication, it should be borne in mind that a variety of other arterial disorders can produce identical complaints, including vascular trauma, arterial embolism, Buerger's disease, extrinsic vascular compression, aortic dissection, Takayasu's arteritis, arteriovenous fistula, coarctation of the aorta, cystic degeneration of the popliteal artery, and arteriospastic disorders such as ergotism. Despite the specific relationship of classic intermittent claudication to arterial insufficiency, there are patients with atypical symptoms in whom the differential must be made from a large number of other causes of lower extremity pain: venous insufficiency, spinal stenosis, arthritis, nocturnal leg cramps, metatarsalgia, peripheral neuropathy, sciatica, myositis, osteoporosis, gout, and plantar neuroma, to mention only some of the more commonly confused conditions.

The clinical significance of intermittent claudication as an indicator of cardiovascular disease has been well illustrated by the longitudinal Framingham Heart Disease Epidemiology Study. In a summary of that experience, Kannel and McGee (1985) affirmed that the onset of claudication increased progressively from age 45 until 75 with a peak in the last decade. Claudication prevalence occurs 10 years later in life than angina pectoris, and males are affected twice as often as females. The most commonly observed associated risk factors were cigarette smoking, diabetes mellitus, and hypertension; hypercholesterolemia was a relatively weak marker for peripheral occlusive disease. Mortality rates during the first 10 years after onset of intermittent claudication were increased twofold in men and fourfold in women in this cohort. The latter observation has particular significance for planning treatment of claudicants, since it must be recognized that more than half of such subjects have coexisting overt cardiovascular disease with life-threatening potential. In addition, the assessment of vascular insufficiency symptoms must be individualized according to

the patient's lifestyle and general health. Certainly, a 60-year-old man who cannot walk 2 to 3 blocks at a moderate pace has a significant disability. This walking limitation might be only an annoyance if the individual is retired and has significant comorbid illness, but it would constitute a real handicap if the person is otherwise in good health and must walk to keep his job. Obviously, a full knowledge of all such factors is required before any decision can be made regarding further diagnostic studies or possible surgical treatment.

References

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